

# **A Unique Approach to Prevention of Heat Strain in D&D Workers**

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### **Biographical Information for Coauthors**

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**Charles J. Satterwhite, CIH**, is certified in the Comprehensive Practice of industrial Hygiene with more than 25 years experience in laboratory, nuclear, university, construction/D&D, and manufacturing settings. Mr. Satterwhite is currently the Industrial Hygiene Lead for the K-27 D&D Project. He has served in leadership roles in the Health And Safety community including former President of the Tennessee Valley Section American Industrial Hygiene Association. Having been involved in Radiological and Asbestos Abatement work at three Oak Ridge DOE Sites (ETTP, ORNL, and Y12) before work controls included systematic consideration of Heat Stress, this subject has been a special interest since the mid 1980's.

**Ram S. Suga, CIH, CSP, CHMM**, is an experienced Environmental, Safety, and Health (ES&H) Professional specializing in Industrial Hygiene, Industrial Safety and Hazardous Waste Management. With certifications including CIH, CSP and CHMM, he has a wide and varied background of over 25 years in the analytical, nuclear, chemical, construction and D&D areas.

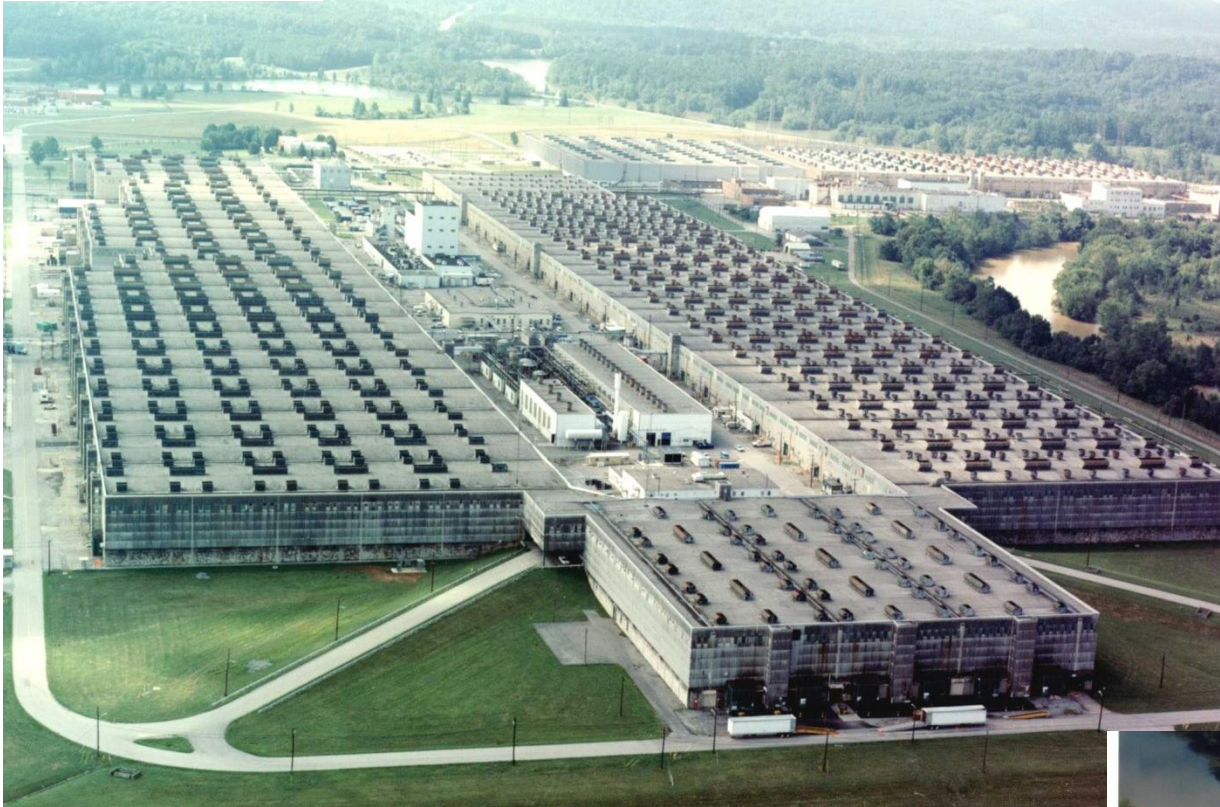
He is currently the Industrial Hygiene Lead for K-25 and has also conducted ES&H oversight of field activities at Paducah KY, Portsmouth OH, Oak Ridge, TN and Brookhaven National Lab. NY. He is a Fellow in Industrial Hygiene from AIHA, a Champion of Excellence from ACHMM, Six Sigma Yellow Belt and a Human Performance Improvement Facilitator. He has co-authored several publications for AIHA. He has also been chairmen for several AIHA committees. He has been conducting professional development courses in many fields of interest in ES&H for many professional organizations since 1980.

## Objectives

- **Overview of Decontamination/ Demolition - CERCLA Cleanup Project to highlight the ES&H challenges we face**
- **Review Hazards and Unique Health and Safety (and Security) Challenges**
- **Discuss “marriage” of Radiological Controls with Industrial Hygiene Controls (e.g., Asbestos/Hazwoper)**
- **Provide an Overview of Heat Stress Controls**
- **Creatively Solving Challenges - Heat Stress**
- **Questions**





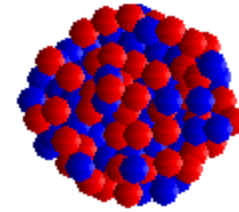
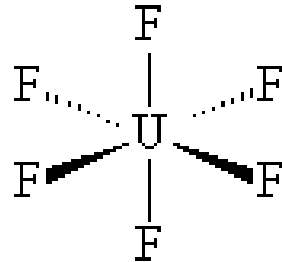


**K-25 building - three-story U-shaped building consisting of wings on the west, north, and east sides. Former Uranium Enrichment “gaseous diffusion” process building.**

**K-27 building - is a rectangular three-story building with the same process design as the K-25 Building.**



# Description of the uranium enrichment process:



- Process for separation of the naturally occurring  $^{235}\text{U}$  and  $^{238}\text{U}$
- Most significant isotope separation process of the Manhattan Project.
- Gaseous  $\text{UF}_6$  is passed through converters/compressors many times - each time increasing the “enrichment” of the product
- The process is based on separation due to the slight mass differences of 235/238
- Requires Fluorinated gas handling capability e.g., nickel plated or lined pipes and containers



■ A  
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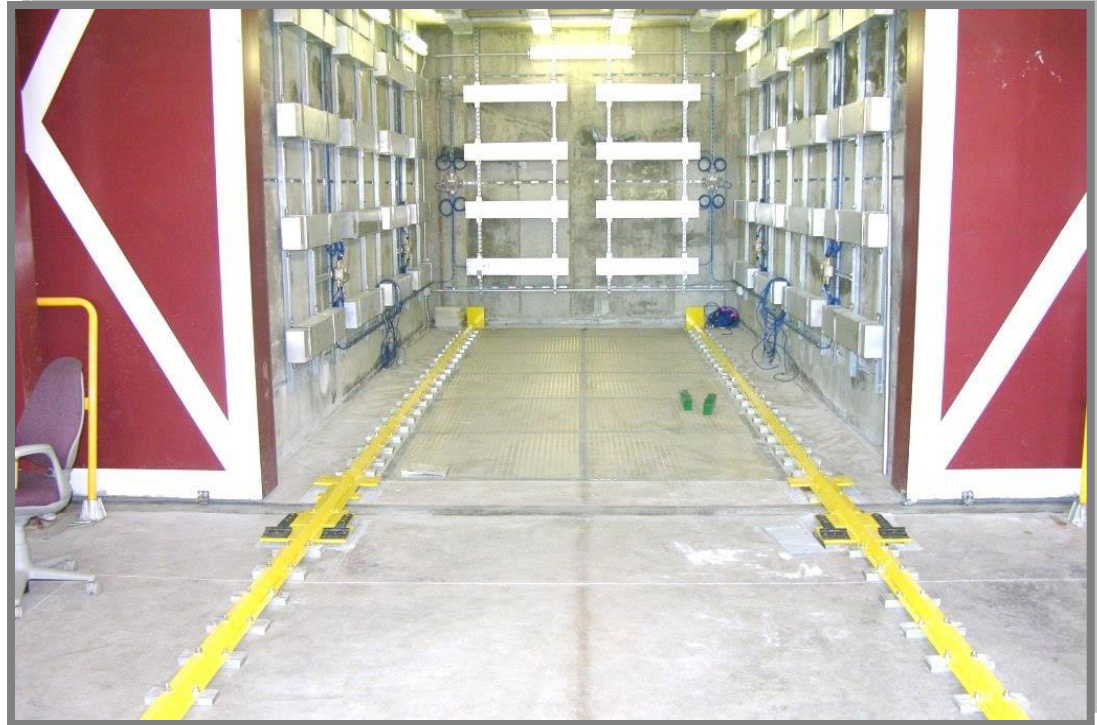
# Asbestos Abatement





## Primary Hazards (continued):

- **Nuclear Criticality Issues – 10 CFR 830**
- **Buildings Must be Criticality Incredible Prior to Demolition**





## Primary Hazards (cont.):

- **Mold** – Minimum of P-95 Facepiece Filtering Mask required for entry
- **Mercury** – Thousands of mercooid switches throughout.



# Primary Hazards (continued)

- Noise



- Process gas - ( $\text{UF}_6$ , Fluorine etc)

- Hydrogen Fluoride (reaction of moist E. Tennessee air with  $\text{UF}_6$  produces  $\text{UO}_2\text{F}_2$  and HF)

- Elevated Work, Physical Hazards, Hot Work

- HAZWOPER









# Vault Cleanout



A photograph of three individuals, two women and one man, standing in front of a brick wall. They are all wearing full-body blue protective suits with black hoods and large, clear respirator masks. The suits have "3M" and "CB-100" printed on them. They are also wearing black gloves and carrying equipment, including a radio and a water bottle. The man in the center is wearing a black respirator mask with "3M" and "GROGETT" printed on it. The woman on the left is wearing a black respirator mask with "3M" and "TRY" printed on it. The woman on the right is wearing a black respirator mask with "3M" and "GROGETT" printed on it. They are all smiling at the camera.





# Preparing for Demolition



**Structures cut open to Foam**

**Foaming equipment to stabilize contaminants**



**Performing hot work on valves**



# VPDI and Foaming



**Foaming Truck Alley Pipe**

**Vent Purge Drain/Inspect**



## K-25: Preparing for Demolition



Sawzall  
cutting



Intrusive Sampling



Converter Removal

# High Risk Equipment Removal



**Pipe Removal**





# UNIQUE HEAT STRESS APPROACH

...To Manage Heat **STRAIN**

- **TRAINING**
- **WBGT TABLES**
- **RADIO / PAGER COMMUNICATION OF WBGT**
- **H.E.A.R.T. CARD**
- **PHYSIOLOGICAL MONITORING USING *POLAR*™ HEART RATE MONITOR**
- **Air Conditioning Zones (Not feasible to cool entire Large Building Area)**
- **Cool Rooms (Drinking water accommodated in “islands” within contamination areas)**
- **“Swamp Coolers” and Cooling Fans**
- **Modified PPE (e.g., reduce from tyvek to aprons where feasible) to mitigate hazard (with heat strain in mind)**
- **Daily IH participation in POD/Tailgate mtgs.**



# UNIQUE HEAT STRESS APPROACH

- ***POLAR*<sup>™</sup> Heart Rate Monitor:**





# H.E.A.R.T. CARDS:

(Heat Evaluation And work-Rest regimen Tool)

**BECHTEL JACOBS**  
Bechtel Jacobs Company LLC

**HEART Card**  
(Heat Evaluation and Work-Rest Regimen Tool)

**Initial Assessment**

GF's and ES&H perform an initial evaluation:  
Work Scope: \_\_\_\_\_

Work Cat. I/M/H: \_\_\_\_\_ PPE Cat. 1/2/2a/3/4: \_\_\_\_\_  
GF: \_\_\_\_\_ IH: \_\_\_\_\_

**Daily Meeting**

	Yes	No	N/A
(1) Is the initial assessment still valid? (Ensure that nothing has changed since the initial screening affecting heat stress [e.g., work location, PPE])?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) Have all workers verified if they are acclimatized on the Worker Sign-In portion of this form (if conducting physiological monitoring)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) Are all workers familiar with the signs and symptoms of heat stress related illnesses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) Are all workers trained and ready to perform Heart Rate Monitoring (if conducting physiological monitoring)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(5) Are all workers aware of the "buddy system"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If the answer to any of the questions above is No, contact your Project Industrial Hygienist.

Date: \_\_\_\_\_

Foreman: \_\_\_\_\_

Location: \_\_\_\_\_

Task Description: \_\_\_\_\_

Monitoring Performed By: \_\_\_\_\_

10 04 2007

# Air Conditioner Being Used in K-25 Building for Heat Relief





## Physiological Monitoring

- **WBGT Tables from Current ACGIH TLV Booklet**
- **Remember: For work beyond recommended maximum limits on WBGT Table - Physiological monitoring is absolutely REQUIRED**

# Individual Crew Assessment

- **IH and GFs (and Foreman as necessary)**
  - ▶ **As a Team, review job scope, conditions, PPE, etc.**
  - ▶ **Categorize Work (L/M/H) and PPE (5 Categories)**
  - ▶ **Flow information to individualized Heart Card for Crew**
  - ▶ **Physiological Monitoring**



## HEART (Heat Evaluation And work-Rest regimen Tool) Card

- **Signing in – Acclimatized?**
- **Baseline at rest (e.g., before stretching)**
- **Use Heart Rate Monitor during work period**
- **Guidance on max heart rates during work/ & “at rest”**
- **Time – WBGT – place to write it when communicated**

### Acclimatization

- For new employees or workers who have been off work for extended absences, contact IH for individual guidance

## Summary:

- **Significantly More Effective (Safer) than Just Work/ Rest**
- **Allows Individual Monitoring**
- **More Practical Than Work/ Rest**
- **Only one Recordable (“Dehydration” Case) In Three Years**
- **High User Acceptance**
- **Management Acceptance**
- **Peace of Mind** for Industrial Hygienist/ Health Physicist